

Lab 2: MATLAB Programming

Assigned on 9/28/2018 (Friday) and Due on 10/5/2018 (Friday)

Question 1: Essay writing (10 points)

Watch the video available at the link below for speeding up MATLAB applications. Write a review that is no longer than two single-spaced, typed pages with normal font and margins. The review should identify what you have learned from watching the video. You may also list the techniques that you have known and those you learned for the first time from the video.

http://www.mathworks.com/videos/speeding-up-matlab-applications-81729.html?form_seq=conf1134&elqsid=1441902641887&potential_use=Education&country_code=US

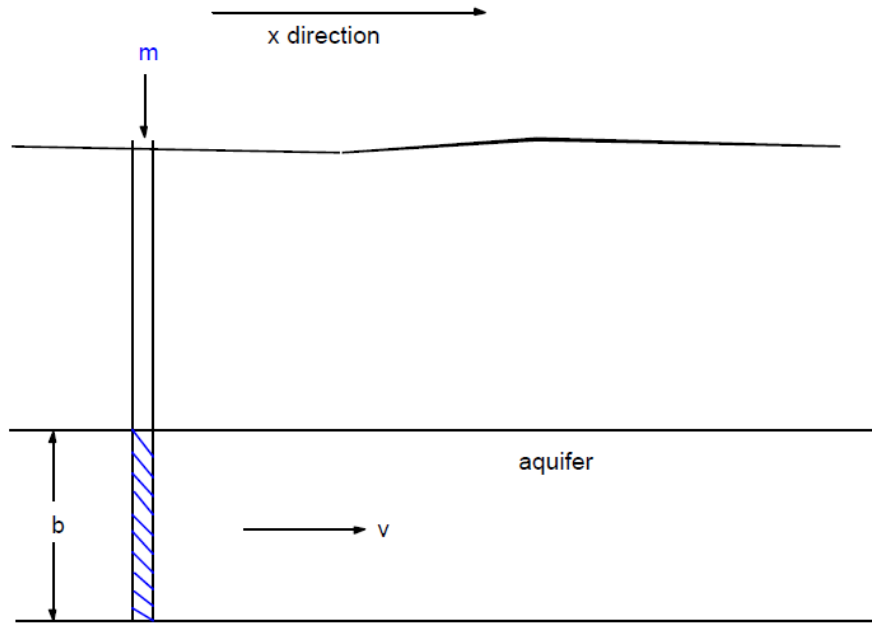
Question 2: Groundwater transport modeling (30 points + 10 bonus points)

Consider a problem involving transport of a non-reactive contaminant with advection and dispersion in a homogeneous aquifer with average pore velocity v . A mass m of contaminant is assumed to be injected instantaneously into an extensive aquifer of thickness b . The contaminant transport is controlled by the flow velocity v and dispersion (determined by the dispersion coefficients, D_x and D_y , of the contaminant) through the governing equation

$$\frac{\partial c}{\partial t} = D_x \frac{\partial^2 c}{\partial x^2} + D_y \frac{\partial^2 c}{\partial y^2} - v \frac{\partial c}{\partial x}$$

where c is concentration. For infinite domain and zero initial concentration, the analytical solution to the equation for this case is

$$c(x, y, t) = \frac{m / b}{4\pi t \sqrt{D_x D_y}} \exp\left(-\frac{(x - vt)^2}{4D_x t} - \frac{y^2}{4D_y t}\right)$$



Write an m-file function, `G_puff`, to compute the concentration with different model parameters: m , D_x , D_y , v , and b . Use the following values for the dimension of the problem:

$x_{\max}=100$, $x_{\min}=0\text{m}$, $dx=2.5\text{m}$
 $y_{\max}=50\text{m}$, $y_{\min}=-50\text{m}$, $dy=2.5\text{m}$
 $t_{\max}=100/v$, $t_{\min}=t_{\max}/50$, $dt=t_{\max}/50$

Run the problem using the following parameter values:

$m=1.0\text{ kg}$, $D_x=0.5\text{ m}^2/\text{day}$, $D_y=0.1\text{ m}^2/\text{day}$, $v=0.5\text{ m/day}$, $b=1.0\text{ m}$

Use `contourf` to plot a contour like the one below.

Hint: Use `meshgrid` to avoid the `for` loop.

The tutorial at the MathWorks below may be helpful for your to understand the `meshgrid` command and to vectorize code in MATLAB.

<https://www.mathworks.com/videos/vectorizing-code-in-matlab-97131.html>

Bonus question: making a movie

If you want to generate the movie, you need to generate contours at a series of times and each "frame" is saved using `getframe`. After executing `G_puff` the command `movie(M)` can be used to display the sequence of frames. The command `set` will be useful for generating the movie.

Look also at the script `ballistic.m` which creates a movie for a simpler problem, but it may make the needed steps more clear.

